U 7430-1.6

A Village Level Study Of Producer Grain Transactions in Rural Senegal

CENTER FOR RESEARCH ON ECONOMIC DEVELOPMENT
The University of Michigan
Ann Arbor, Michigan 48109

Discussion Paper 81

June 1979

A Village Level Study Of Producer Grain Transactions in Rural Senegal

Clark G. Ross
June 1979

US-AID/csd-2547
Center for Research on Economic Development
The University of Michigan
Ann Arbor, Michigan

US-AID/AFR/C-1257
Dept. of Agricultural Economics
Purdue University
W. Lafayette, Indiana

Centre de Recherche
Economique Appliqué
Université de Dakar
Dakar, Sénégal

TABLE OF CONTENTS

		Page
Preface		i
Chapter I	Introduction	1
Chapter II	The Senegalese Agricultural Sector	3
Section 1	Production	3
Section 2	Marketing	4
Section 3	Price Policy	7
Chapter III	The Villages and Families Surveyed	10
Section 1	Geographic and Physical Setting	10
Section 2	Socio-Economic Characteristics	10
Section 3	Typical Agricultural Exploitation	13
Section 4	Marketing Alternatives	14
Chapter IV	Analysis of Grain Transactions	18
Section 1	Compound Production	18
Section 2	Consumption of Grains	21
Section 3	Purchase of Grains	23
Section 4	Sale of Grains	27
Section 5	Gifts, Food Aid, and Borrowing/ Lending of Grains	40
Section 6	Summary of Major Transactions	44
Chapter V	Major Findings and Recommendations	47
References		51

Preface

This study of producer grain disposition was a joint effort by CRED University of Michigan (Grant: US-AID/csd 2547), Purdue University (Grant: US-AID/AFR-C-1257), and CREA University of Dakar. Appreciation for the direct funding of this study is extended to CRED and to Purdue University. Mr. Makhtar Diouf of CREA provided many supporting services for the project.

The interviewing of the farming families was coordinated with the Institut Sénégalais de Recherches Agricoles (ISRA) through their Centre National de Recherches Agronomiques (CNRA) at Bambey. Mr. Moussa Fall, Director of the US AID sponsored "Programme Moyen Terme Sahel/ cellule de liaison" at Bambey graciously made available his enumerators to collect the data on grain transactions which are analyzed in this report. These data were collected from July 1977 to June 1978.

Completion of the work in the United States was facilitated by Purdue University's preparing of the data for computer analysis with Dr. Margaret Saunders supervising this aspect of the work. David Jick from the University of Michigan was responsible for the computer analysis of the data set. Finally, helpful suggestions were received from Professors Elliot Berg and Richard Porter (CRED, University of Michigan) and Wilford Morris (Purdue University).

Clark G. Ross
CRED, University
of Michigan
June 1979

CHAPTER I

INTRODUCTION

To encourage economic development and food self-sufficiency, the Sahelian countries of West Africa have joined together in forming CILSS (Interstate Committee for the Fight against Drought in the Sahel).[1] CILSS has formed committees to study various aspects of the area's agricultural problems. One of these committees, Marketing, Price Policy, and Storage, commissioned the University of Michigan's Center for Research on Economic Development (CRED) to undertake a diagnostic study of food grain marketing and price policy in each of the CILSS states. The CRED study, released in August of 1977, succeeded in two respects. First, it provided basic descriptions of grain price policy, marketing activity, and storage capacity for each country. Second, the CRED study identified topics for which additional research is needed to resolve strongly contested issues.

These debated issues to a large extent revolve around the competitiveness of the Sahelian grain trade. Those stressing the lack of competitiveness in the current situation envision a marketing system dominated by large traders possessing monopsonic power over producers and monopolistic power over consumers with consequent low producer and high consumer prices. Proponents of this view of grain marketing argue for extensive state intervention, favoring schemes such as national marketing boards (with monopoly power and guaranteed prices) and national buffer stock or storage programs.

The CRED study found little empirical evidence to evaluate the competitiveness of grain marketing, because reliable micro-level data were not available. Obviously, studies of consumer, producer, and trader behavior are needed to clarify the issue.

A study concentrating on producer behavior was begun in Senegal in 1977. From July 1977 to July 1978 interviewers recorded all grain transactions (consumption, sales, purchases and other exchanges) for thirty

---

[1] The Gambia, Senegal, Niger, Chad, Mali, Upper Volta, Mauritania, and Cap Vertian Islands.

families (ten families in each of three villages).[1] Ideally, the data collected should provide insight in the following key issues:

A. Grain consumption of the peasant family.

B. Degree of self-sufficiency attained by the farmer.

C. The magnitude and timing of producer sales.

D. Outlets of sale or intermediaries used by the producer.

E. Prices received by the producer for his grains.

This study is organized as follows: Chapter II provides a description of Senegalese agriculture. Chapter III identifies the three villages used in the study and details the marketing alternatives available to producers in each village. Chapter IV summarizes the empirical findings, which are generally supportive of the competitive hypothesis, and attempts to interpret these results. Finally, Chapter V presents the study's major conclusions, relating them to Senegalese agriculture policy.

---

[1] The services of the interviewers and names of families were kindly provided by Mr. Moussa Fall of CNRA Bambey.

CHAPTER II

THE SENEGALESE AGRICULTURAL SECTOR

This chapter attempts to provide the background information on Senegalese agriculture necessary for an understanding of this study. Included are sections describing production, marketing, and price policy.

Section 1 - Production

Of the 5.1 million Senegalese, approximately 70 percent live in rural areas, with agriculture as their primary activity. Groundnut production is the single most important agricultural activity, with most output being transformed to groundnut oil and exported. As a result of this specialization, Senegal had relied heavily on commercially imported foodgrains, particularly rice.

Groundnut hectarage has shown a fluctuating but upward trend in recent years, concurrent with increases in the producer price and resulting profitability of groundnuts. Production, varying with rainfall patterns, has ranged from 583,000 tons in 1970 to a high of 1,100,000 tons in 1975. The Groundnut Basin of Senegal, comprising the regions of Thiès, Diourbel, and the Sine Saloum, accounts for 80 percent of total groundnut production. The three villages followed in this study are all located in the Groundnut Basin.

Millet production, primarily destined for self-consumption, has varied from 322,000 tons in 1972 to 770,000 tons in 1974. In recent years a slight reduction in land devoted to millet production has occurred as peasants have increased factors allocated to groundnuts. Millet is grown throughout Senegal and is the prinicpal grain in the diet of most rural inhabitants.

Two other crops that are relatively important for Senegalese agriculture are rice and maize. Ambitious rice projects hope to increase production from the current 100,000 tons to 300,000 tons annually, eliminating rice imports, which currently average 200,000 tons per year. Maize

production has remained relatively constant at 47,000 tons during the last four years.

Section 2 - Marketing

There are three principal groups involved in the marketing of agricultural products in Senegal. First, the governmental agency, ONCAD, (Office National de Coopération et d'Assistance pour le Dévéloppment) has a legal monopoly for the primary purchase of groundnuts and millet, as well as responsibility for the sale and distribution of agricultural inputs. Second, various regional development organizations, while primarily responsible for agricultural extension activity and the development of new lands, engage in commercial activities. Finally, the private sector is engaged in the marketing of millet, maize, and rice. A brief description of the marketing channels (in theory and in fact) for the two principal agricultural products, groundnuts and millet, now follows.

A. Groundnuts

ONCAD's monopoly appears to be effectively enforced, since it is the sole legal seller of groundnuts to the groundnut oil mills. Producers sell their groundnut crop to ONCAD groundnut cooperatives, which are present in all regions of Senegal.

The official producer price for groundnuts is announced in mid-November and the buying season generally begins in early December. Official producer prices for groundnuts, millet, and rice are recommended by an intra-governmental committee, Committee of Great Agricultural Products (CGPA).

B. Millet

The three forces previously described - ONCAD, regional development organizations, and private traders - are all involved in the marketing of millet in Senegal. Since its inception in 1966, ONCAD has been a purchaser of producers' millet. From 1964 until 1975 ONCAD acted in competition with a legal private sector.

In 1975 ONCAD was awarded a legal monopoly for the primary collection of millet. In principle, only ONCAD seccos or specially licensed traders would have the right to purchase millet from the producer. The Committee

of Great Agricultural Products was empowered to establish prices and profit margins at each stage in the marketing process. Grain purchased by ONCAD would either be resold to licensed wholesalers for eventual consumer sale, sold to cooperatives in deficit areas, or used to establish a security stock.

The ONCAD monopoly was aimed at improving the marketing of millet from both the perspectives of efficiency and equity. ONCAD's hope was that in controlling the marketing of millet, the assumed excessive profits of the trader would be eliminated. In theory, there would be a higher producer price to the farmer and a lower final price to the consumer. Also, economies of scale in millet marketing were claimed; thus ONCAD's monopoly position would presumably lower intermediate costs. The monopoly was further defended in light of Senegal's perennial grain deficit and resulting rice imports. Higher producer prices were expected to stiumlate millet production, slowing the trend toward allocating additional resources into groundnuts. Further, a lower consumer price would increase millet consumption by the non-agricultural urban population, tending to reduce rice imports.

In the first year of operations following the reception of their monopoly, 1975/1976, ONCAD succeeded in purchasing only 12,125 tons, or 2 percent of the Senegalese millet production. These purchases were 23,844 tons less than those of the preceding year in which ONCAD and the private sector legally coexisted. During the 1976/1977 campaign, for which the official producer price was raised to 35 CFA/kg, ONCAD's purchases of millet further declined.[1]

Even those most sympathetic to ONCAD's monopoly position agree that the results have been far from satisfactory. To those in support of ONCAD's monopoly position, current purchasing problems are temporary, stemming from poor harvests and initial ONCAD inexperience.

Others less sympathetic to the monopoly position argue that the problems are more structural in nature and that ONCAD will never succeed in controlling the millet market. First, it seems ONCAD has little interest in enforcing its millet monopoly. The producer price of 35 CFA/kg coupled with a 43 CFA/kg resale price to approved traders leaves

---

[1] A sharp increase in the producer price from 35 CFA/kg to 40 CFA/kg, as well as, a good millet harvest permitted ONCAD to purchase nearly 100,000 tons of millet in the 1978-79 campaign.

a margin on only 8 CFA/kg for ONCAD. This margin is insufficient to cover the costs of purchase, transport, storage, and resale.[1] Thus, the millet operation is done at a financial loss. Also, ONCAD does not facilitate millet purchasing, maintaining only thirty-nine seccos, or millet buying points.[2] A peasant is often ten or fifteen kilometers from the nearest secco.

A question of more primary importance is whether ONCAD's millet operations must be performed at a deficit. Critics of the ONCAD monopoly argue that ONCAD has no legitimate market function to perform. In theory ONCAD purchases millet from the peasant at 35 CFA/kg and sells to an approved trader at 43 CFA/kg. Assuming that the private trader can reach the peasant and his millet as easily as ONCAD can, the private trader could offer the peasant an intermediate price, 40 CFA/kg, for example. In such a case, both the producer and the trader receive a better price.[3]

One of the questions investigated in this report is whether the private trader does in fact pay the peasant a price in excess of ONCAD's producer price (35 CFA/kg) but less than ONCAD's resale price (43 CFA/kg). In a competitive situation, the answer would be affirmative as trader competition would bid up the producer price from ONCAD's floor price. On an a priori basis, a number of factors suggest a strong degree of competition. First, traders must compete with the peasant's own need for food. Since the peasant's primary cash needs are met through the sale of groundnuts, the peasant is less obligated to sell millet.

A second reason to expect strong competition in millet marketing is the visible presence of large numbers of active traders in Senegal. The relatively small distance between major markets and producing areas as well as a relatively good transport infrastructure imply frequent contact between peasants and traders. This degree of competition would imply that price savings (as from avoiding ONCAD) or demand-stimulated price increases would be passed on to the producer by the traders.

---

[1] SONED Study figures.

[2] In contrast to the 1800 groundnut purchasing cooperatives. During the 1978/79 campaign the number of millet buying points was greatly increased.

[3] ONCAD's difficulty in reselling millet purchased during the 1978/79 campaign indicates that traders do prefer dealing directly with the peasants.

Section 3 - Price Policy

As previously mentioned, Senegalese agricultural prices are officially set by governmental decree. The stated phiolosphy of the price committee is to set prices which promote (1) the agricultural objectives of the government, and (2) greater economic equity. Without considering possible conflicts within this dual objective, it is sufficient to realize that the Government of Senegal views the price-setting activities of the CGPA as a policy instrument. The fundamental issue however, is the degree to which the GOS can autonomously set prices which differ from market prices.

An important factor is the extent to which the market is controlled by the government. Naturally, a sole purchaser or sole seller of a product has greater ability to enforce controlled prices. In the case of agricultural products in Senegal, the Government effectively controls the purchase of groundnuts from the farmer and the sale of imported rice to traders. However, the government marketing board controls little of the domestic millet market, with the private sector handling the preponderance of millet.

Encouraging food self-sufficiency by increased local production of rice and millet is a stated objective, toward which price policy has been directed. The official prices for major products follow:

	1973-74	1974-75	1975-76	1976-77	1977-78
Groundnuts	25.56	41.5	41.5	41.5	41.5
Millet	25.96	30.0	30.0	30.0	35.0
Maize	25.00	35.0	35.0	35.0	35.0
Rice (Paddy)	25.00	41.5	41.5	41.5	41.5

CFA/kg

After the producer groundnut price increase in 1974, resources were channeled into the production of groundnuts, at the expense of millet. Consequently, the government in 1976 increased the official price of millet, leaving the groundnut price unchanged. Millet supply, however, was not

greatly stimulated because groundnut production remained considerably more profitable than millet cultivation.

A relevant question is whether consumer demand could raise the free market price of millet to the point where its production would be more profitable than that of groundnuts. At the 41.5 CFA/kg price for groundnuts, an estimated producer price of 58-60 CFA/kg for millet is needed to induce the producer to shift resources from groundnuts to millet. Including all intermediate costs and margins, millet would have a cost price of 80-90 CFA/kg in Dakar. Currently, imported broken rice to which the Senegalese consumer has a strong preference sells for 80 CFA/kg. As long as rice is available at this price, consumer demand for millet in the food deficit urban areas will be limited.[1] In summary, food self-sufficiency is hindered by the same official price structure whose stated aim is to encourage food self-sufficiency. The official prices which have economic significance are the producer price for groundnuts and the consumer price for imported rice. At current levels both of these prices discourage food self-sufficiency, by encouraging specialization in groundnuts and importation of rice.

The feasibility of attaining self-sufficiency should be addressed. While there are short-run economic benefits to the current situation of specialization and trade, adverse (to Senegal) world price changes for groundnuts and/or rice could disrupt the Senegalese economy. A greater degree of food self-sufficiency as protection against devastating price changes may be desirable.

Basically, a price policy which diverges from world market prices may be needed. A decrease in the producer price for groundnuts, a tariff on imported rice, or some combination of the two should be considered. A decreased producer price for groundnuts would shift resources into millet production. A higher consumer price for rice could render locally grown rice economically feasible and also would stimulate demand for millet. The exact magnitudes of the groundnut price change and/or the

---

[1] Further, the actual degree of substitutability between millet and rice in Dakar is unclear. Rice is primarily consumed at mid-day, while millet is exclusively consumed in the evening.

rice tariff depend on the desired degree of food self-sufficiency and the underlying production and consumer demand functions. The short-run economic costs of pursuing food self-sufficiency are obvious. Producers receive a lower price for groundnuts; and, even with the higher price for millet, farmer income would fall.[1] Consumers would pay a higher price for rice and for millet. These costs must be weighed against the benefits of greater food self-sufficiency.

---

[1] A particularly high tariff on imported rice could conceivably force the price of millet upward to the point where income for certain farmers actually increased. In this case the full burden of pursuing food self-sufficiency is being borne by the non-producing consumer of grains.

CHAPTER III

THE VILLAGES AND FAMILIES SURVEYED

This chapter describes the villages and the socio-economic characteristics of the families followed in this study.

Section 1 - The Geographic and Physical Setting of the Villages

The three villages used in this study are located in the Thiès-Diourbel region of the Groundnut Basin, the most important agricultural area of Senegal. The accompanying map locates the three villages. Got, with a population of 264, is seventeen kilometers southeast of Thiès through the village of Noto, within two or three kilometers of Got.[1] N'diamsil Séssene (population 305) is the most isolated of the three villages. Located about eighteen kilometers northeast of Khombole, access is provided by a network of sandy trails extending from the main dirt road connecting Khombole with Baba-Garage. This dirt road passes through Touba-Toul, an important weekly rural market. The final village, Layabé, is about twenty-three kilometers north of Diourbel. Access to this village of 380 inhabitants is provided by the main dirt road running from Diourbel to N'dindi.

As is evident from the map, each village is reasonably close to the main highway running from Dakar to Diourbel. This provides potential for an easy exchange of products and ideas between these villages and the urbanized Cap-Vert (Dakar) region. Agricultural products can be shipped from these villages toward the urban markets, and consumption goods can easily flow toward the villages.

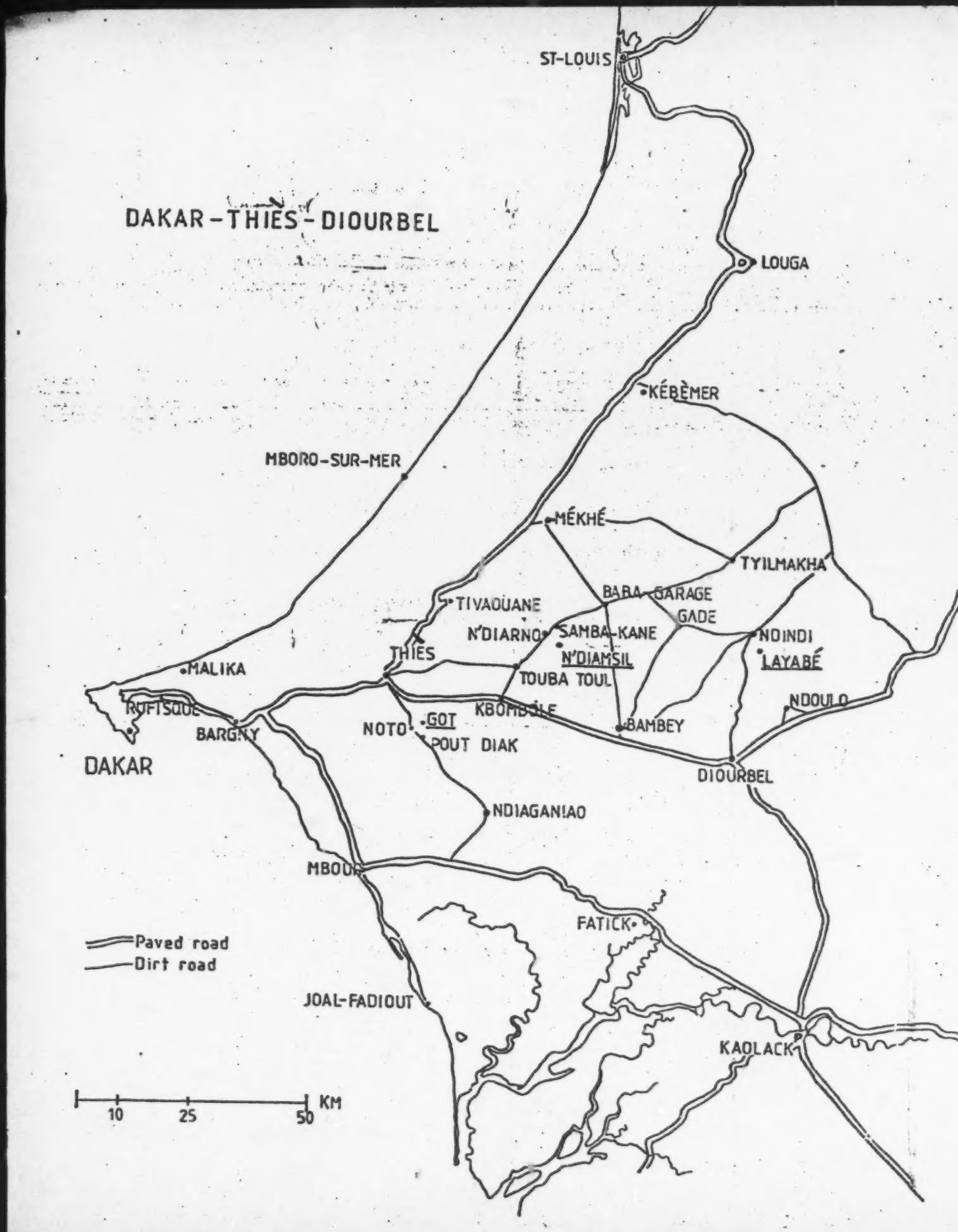
Section 2 - Socio-Economic Characteristics of the Villages

All three villages are predominately Wolof in ethnic composition and Moslem in religious affiliation. N'Diamsil is regarded as the most traditional of the three villages and has the most religiously strict population. Got, near Thiès, and Layabé, near Diourbel, have greater exchanges with the less traditional urban population.

For the agricultural camapign of 1975-76, summary production and input

---

[1] All population figures are for 1976.


DAKAR - THIES - DIOURBEL
ST-LOUIS
LOUGA
KÉBÈMER
MBORO-SUR-MER
MÉKHÉ
TYILMAKHA
BABA GARAGE
TIVAOUANE
GADE
N'DIARNO
SAMBA-KANE
NDINDI
THIES
N'DIAMSIL
LAYABÉ
MALIKA
TOUBA TOUL
NDOULO
RUFISQUE
KBOMBOLE
NOTO
GOT
BAMBEY
BARGNY
POUT DIAK
DAKAR
DIOURBEL
NDIAGANIAO
MBOUR
FATICK
Paved road
Dirt road
JOAL-FADIOUT
KAOLACK
10
25
50
KM

data were collected by CNRA at Bambey through interviews with ten families in Got, five in N'Diamsil, and ten in Layabé.[1]

Table I presents information on the average land surface area and working population by family for each village.

TABLE I
1975/1976

Village	Surface (ha.) Available	No. of Workers[a]	Surface Groundnuts	Surface Millet	Hectare Workers	Surface Groundnuts / Surface Millet
GOT	11.31 (7.08)[b]	5.86	7.51	3.80	1.93 (0.59)	1.98
N'DIAMSIL	14.22 (7.20)	7.65	7.72	5.72	1.86 (0.29)	1.35
LAYABÉ	15.52 (0.86)	6.00	9.23	5.15	2.59 (1.11)	1.79

[a] The number of workers is calculated using effective working units which give the following weights for each age-sex classification: Man 1., Boy .5 (8-14 years), Woman .5, Girl .2 (8-14 years).

[b] When available the standard deviation is shown in parantheses.

Certain conclusions emerge from these data. First the average hectarage per farm in these villages is greater than that for Senegal as a whole. Secondly, in each village the surface devoted to groundnut cultivation is sginificantly greater than that devoted to millet cultivation, reflecting the greater profitability per hectare of groundnuts than of millet. In N'Diamsil the groundnut/millet surface ratio is the lowest. This is probably due to a greater desire for food self-sufficiency in this most isolated of the three villages.

[1] In the following year the number of families was increased to ten in N'Diamsil.

Table II shows the degree to which families are self-sufficient in cereal needs for each village.

TABLE II

CEREAL PRODUCTION, 1975/1976

	Got	N'diamsil	Layabé
Family Millet Production	1039.4 kilo	2332.8	2366.5
Number of inhabitants[a]	12.6	14.8	11.1
Millet per inhabitant	82.5 kilo/person	157.6	213.2

[a] This is the actual number of people in the family as contrasted with the calculated number of workers used in Table I.

Assuming that 200 kilograms of unmilled cereals per person are necessary during a year, only in Layabé is the typical family self-sufficient. In Got the average family's production only covers 42 percent of assumed grain needs. Income earned from groundnut production and from off-season economic activities permit the families of Got to purchase a larger proportion of their grain. In N'Diamsil, even though it was shown that families devoted a greater proportion of their exploitable land to cereal crops than in the other villages, the typical family was only 79 percent self-sufficient in cereals. In Layabé, even though the typical family was self-sufficient in cereals, four of the ten families harvested less than 200 kilograms per person.

Section 3 - The Typical Agricultural Exploitation

The purpose of this section is to familiarize the reader with the decision-making process found in the Wolof type agricultural exploitation in Senegal.

This discussion primarily draws on work by Paul Kleene.[1] He claims the exploitation revolves around the carré (compound), whose principal

[1] The description presented in this section is drawn from Kleene: "Notion D'Exploitation Agricole et Modernisation en Milieu Wolof Saloum", L'Agronomique Tropicale XXI-1, Janvier-Mars 1976.

fields are directed by the chef (leader) and whose secondary fields are worked by the men and women dependent on the chef for their food. These dependents include the leader's wives, children, nephews, brothers, and even hired "strange" farmers.[1]

At the beginning of the agricultural campaign the leader assigns each woman and man over fifteen years of age at least one parcel of land to cultivate groundnuts. The leader usually reserves for himself the cultivation of millet on fields close to the compound, in recognition of his obligation to feed his dependents. Agricultural material, both equipment and animal, is under the control of the leader. Seeders, some type of animal traction for land preparation, and weeding equipment are used to varying extents by most of the producers in this study.

After the harvest, the year's crops are at the disposition of the leader. He must first repay his groundnut seed debts to the ONCAD secco and then sell his groundnut crop. A portion of these receipts will be given to each exploiter of a field, with the leader retaining a portion for lodging and food expenses. Depending on his cash position (need for money), his perception of price trends, and the available market outlets, the leader considers the timing of his millet sales. However, no a priori decision rule concerning the disposition of the farmer's millet can be advanced. Millet cultivation is primarily viewed as a direct food source for the family, but significant amounts are devoted to other uses (sales, baptisms, repayments, loans, gifts). This empirical study tries to identify the magnitudes of these other uses.

Section 4 - Market Alternatives

This section will describe the marketing outlets available for residents of each village. A description of the different possibilities for grain disposition is first presented.

1. Consumption - A large portion of the millet grown is self-consumed by the producer.
2. Gifts - Gifts of millet for religious festivals or charity are common.

---

[1] The strange farmer is a migrant worker who spends the agricultural season with a host farmer. While working on the leader's fields, he also has certain rights to cultivation.

3. Loan Reimbursements - Common within a village are temporary transfers/loans of millet or rice.
4. Purchase -
   a. Rice - Within the village there are small boutiques selling rice; also, farmers have access to rural and urban markets.
   b. Millet - Farmers in need of millet can usually find a villager willing to sell small quantities.
5. Sale -
   a. Groundnuts - The crop is delivered by the producer to a groundnut cooperative -- at most, two or three kilometers from the village, if not in the village. Prior to the sale of his product, the farmer is obligated to repay his groundnut seeds at an ONCAD secco.
   b. Rice - The producers in this region do not cultivate rice.
   c. Millet - The farmer has many options for the sale of millet.
      i. ONCAD - The legal purchaser of millet is the ONCAD secco in the producer's area, offering the farmer the official producer price; 35 CFA/kg (1977/1978).
      ii. Neighbor in the village.
      iii. Village collector - Often within the village a small storekeeper will purchase millet in small quantities (3-10 kg) from producers and collect this millet in larger sacs for eventual resale to rural traders. This system gives the producer an ever present outlet for small quantities of millet. Often, the cash he receives is spent in the same store for rice, oil, or other goods.
      iv. Rural collector - Traders visit the village to purchase millet either from the producer or village collector. This rural collector primarily supplies urban millet sellers.
      v. Rural market - The producer may take millet to the rural market in his area. These markets are usually weekly events, attracting large numbers of buyers and sellers.

vi. Urban inhabitant - Often an urban dweller will visit a village accessible from the highway to purchase millet.

In principle options ii - vi are illegal, due to the official monopoly role given to ONCAD.

6. The use of millet for seed and for animal feed has been noted by the interviewers and included in the statistical results.

The specific marketing options associated with each village are now detailed.

A. Layabé

The following commercial circuits can be identified for the inhabitants of Layabé. (See Map: Chapter III, Section 1)

Rice: Generally, rice is purchased within the village but a wide variety of imported rice can be found about twenty-five km south of Layabé in Diourbel.

Groundnuts: Within the village there is a groundnut cooperative; repayment of the seed debt is made at the secco located in Diongo, three kilometers west of Layabé.

Millet: a. Official Channel - the ONCAD secco located in Diongo is the presumed locality for the sale of producer's millet to ONCAD. Transport between the village and the secco is easily found; the normal charge is 100 CFA for a cart with a horse or one CFA/kg for 100 kgs. The Layabé producer can sell to ONCAD with a minimum of inconvenience and expense.

b. Parallel Market - Rural traders frequently visit the village to purchase millet, or millet is sold at Tyilmakha, an important rural market.

B. N'Diamsil

The following commercial circuits can be identified for the inhabitants of N'Diamsil.

Rice: Rice can be purchased from a village boutique. The consumer can find a wider selection of rice at a weekly rural market -- Touba Toul (Saturday) or Samba Kané (Tuesday).

Groundnuts: A producer cooperative is located in Samba Kané, about

five kilometers from N'Diamsil, and another cooperative is in Ndiarno, about four kilometers from N'Diamsil. Transport charges to both cooperatives by horse and carriage are 150 CFA per 100 kilograms or 1.5 CFA/kg. The secco serving the N'Diamsil population is located at Samba Kané where seed debts are repaid.

Millet: a. Official Channel - The ONCAD secco at Samba Kané.

b. Parallel Market - The peasant often sells larger quantities of millet at the weekly market at Touba Toul, since prices are more attractive than those prevailing in the village. The average transport charge from N'Diamsil to Touba Toul is only one CFA/kg of millet. As indicated on the map, only eight kilometers of a relatively good dirt road separate Touba Toul from the main Dakar-Thiès-Diourbel highway. Thus, many traders and inhabitants of Thiès and Dakar attend this market.

C. Got

The following commercial circuits can be identified for the inhabitants of Got.

Rice: Rice is either purchased locally in village boutiques or in Thiès if larger quantities or scarcer varieties are sought.

Groundnuts: The residents of Got can use cooperatives located in Noto (two km away) and Pout Diak (five km away). The secco for the repayment of groundnut seed is in Noto.

Millet: a. Official Channel - The ONCAD secco for the sale of millet is conveniently located in Noto.

b. Parallel Market - Got producers can sell millet at village boutiques or in the neighboring markets of Noto and Pout Diak, or in the urban Thiès market. Even within the village there is demand for millet since the typical Got family is not self-sufficient in millet.

CHAPTER IV

ANALYSIS OF GRAIN TRANSACTIONS

This chapter will present the empirical findings from the study of grain transactions in the three villages. Production, consumption, purchases, sales, and other transactions will be reviewed in separate sections. A concluding section will summarize these results.

To avoid confusion with the annual identification of data items, a brief review of the chronology of this study is in order. The enumerators began recording household grain transactions in July 1977 and terminated in July 1978, after one full year. Data items collected during this time period will be referred to as 1977/78 data. Production and input usage data are collected for an agricultural year - planting occurring in June with a harvest in late November. These data will be identified by a single annual notation - 1977 refers to crops planted and harvested in 1977. Obviously, the grain dispositions noted by the enumerators are from both the harvests of 1976 and that of 1977.[1]

Section 1 - Compound Production

The data presented in Table I, detailing hectarage, production and yields per hectare for the typical compound in each village differ slightly from those presented in Chapter III-2 for the agricultural year 1975. Between 1976 and 1977 there is a slight decrease in the mean total hectarage per compound, in all villages except Layabé. More striking is the dramatic fall in groundnut production from 1976 to 1977; the mean sample yield/hectare for groundnuts fell from 1033 kg to 345 kg. This is primarily due to the absence of rains in late June and early July 1977 when groundnuts were being planted.

On a per capita basis, millet production ranged from 111 kg in Got in 1977 to 358 kg in N'Diamsil in 1976. The discussion (Chapter III-2) of the 1975 socio-economic base data assumed a 200 kilogram per capita

---

[1] Also, grain stored from previous harvests could be included.

TABLE I

MEAN COMPOUND PRODUCTION STATISTICS

ITEM	VILLAGE	GOT	N'DIAMSIL	LAYABE	TOTAL SAMPLE
1. No. Actives	1977	5.2	6.0	5.5	5.6
2. Ha Millet	1977	4.07	4.91	6.10	5.06
	1976	4.48	5.53	5.50	5.10
3. Ha Groundnuts	1977	6.72	5.04	7.36	6.37
	1976	7.70	6.15	7.53	7.11
4. Total Ha	1977	10.79	9.95	13.55	11.43
	1976	12.18	11.68	13.03	12.30
5. Production Millet (kg/compound)	1977	1222	3655	4015	2964
	1976	1962	4830	2470	3126
6. Production Groundnuts (kg/compound)	1977	1930	1134	3534	2200
	1976	5801	6332	9757	7348
7. Yield Millet (kg/ha)	1977	300	744	649	586
	1976	438	873	449	602
8. Yield Groundnuts (kg/ha)	1977	287	225	480	345
	1976	753	1030	1296	1033
9. Ha/Active	1977	2.08	1.66	2.46	2.05
10. Population (per compound)	1977	11.0	13.9	11.6	12.2
	1976	11.8	13.5	11.6	12.4
11. Millet Production (kg/capita)	1977	111	263	246	243
	1976	166	358	213	252
12. Surface Groundnuts ÷ Surface Millet	1977	1.65	1.03	1.10	1.26
	1976	1.72	1.11	1.37	1.37
13. Value of Groundnut Crop	1977	$341	$200	$624	$389
	1976	$1025	$1118	$1723	$1298

[a]There were 10 household compounds in each village, a total sample of 30 compounds, except for Got which only had 9 in 1976.

[b]The value of groundnuts is calculated at the official price of 41.5 CFA/kg, (41,500 CFA/ton) approximately $176.60/ton at 235 CFA/$.

annual grain requirement for the population. Assuming 10 percent milling losses this requirement is equivalent to an annual consumption of 180 kilograms of cereals.[1] Thus, in both 1977 and 1976, the mean sample compound produced in excess of its annual nutritional needs.

More specifically, Table II shows the number of compounds in each village which produced in excess of 200 kilograms per capita in 1977 and 1976.

TABLE II

NUMBER OF COMPOUNDS IN EXCESS OF 200 KG OF MILLET PER CAPITA

	GOT	N'DIAMSIL	LAYABE	SAMPLE
1977	2	8	10	20
1976	3	10	8	21

(a) In Got during 1976 only 9 compounds were followed; all other villages had 10. Thus the sample size for 1976 is 29 and that of 1977 is 30.

Consistent with the village means shown in Table I, in thirty-six of the forty cases (1976-1977) the compounds of N'Diamsil and Layabé produced in excess of 200 kg per capita. In Got, however, only five of the nineteen compounds met the consumption requirement. The smaller hectarage per compound devoted to millet in Got as well as substantially lower millet per hectare yields cause this shortfall in Got. Nearly all compounds in N'Diamsil and Layabé are capable of meeting their full grain needs with their own production. As will be shown in the next section, however, most compounds in these villages elect to diversify their diet by purchasing rice.

Groundnuts, as previously discussed, are nearly entirely sold to the local ONCAD cooperative at the official price of 41.5 CFA/kg. As

[1] The Gambia River Basin Development Committee has posited 182.5 kg of milled grains as the annual per capita requirement.

can be seen from Table I, mean compound groundnut production fell by 70 percent from 1976 to 1977. Since the cash income position of farmers would have been correspondingly adversely affected, there may have been greater inducement for the farmer to sell millet, recouping that income lost from groundnuts. This influence should be considered when evaluating the millet sales decision.

Section 2 - Consumption of Grains

Table III summarizes the recorded annual grain consumption of the sample households.

Certain points merit discussion. First, the recorded levels of annual per capita grain consumption for N'Diamsil and Layabé approached the standard of 180 kilograms of milled cereals. In Got, however, the annual per capita grain consumption is significantly lower, 128 kg.[1] There is no obvious explanation for this discrepancy. Per capita rice consumption in Got, as expected, was significantly greater than in the other two villages. The consumption deficit in Got is primarily in millet of which the per capita consumption is only 87 kilograms. Since the 1977 millet harvest in Got was substantially below that of 1976, reduced millet consumption should be expected. This decreased millet consumption should theoretically be replaced by increased rice consumption. Nevertheless, the calculated statistics, if correct, indicate a grain deficit for the inhabitants of Got.[2]

The percentage of millet in the household diet is highest in N'Diamsil -- the most isolated and traditional village. In Layabé, rice plays a more important role, accounting for 16.2 percent of annual grain consumption. The financial position of the Layabé farmer, with his importat groundnut production, permits him to purchase rice and other foods more easily. This observation is germane to the general question of food self-sufficiency in in Senegal. Growing urbanism and rising farm incomes will probably lead to increases in rich purchases as the rural population attempts to diversify

---

[1]Each of the per capita annual consumption estimates are biased downward since the compound population has not been adjusted for any dry season out-migration. This is particularly important in Got, where younger compound members often go to Dakar or Thiès in search of off-season employment

[2]Of course, the greater accessibility to fresh vegetables, fruits, and fish by the population of Got reduces somewhat the quantity of grains needed.

TABLE III

ANNUAL HOUSEHOLD GRAIN CONSUMPTION, 1977/1978

Item/Village	Got	N'Diamsil	Layabé	Sample
1. Compound Millet Consumption, kg	920	1893	1620	1477
2. Compound Rice Consumption, kg	448	180	309	312
3. Total Compound Grain Consumption, kg	1368	2073	1929	1789
4. Population/Compound	11.0	13.9	11.6	12.16
5. Millet/Capita, kg	87	160	150	132
6. Rice/Capita, kg	41	14	29	28
7. Grains/Capita, kg	128	174	179	160
8. % of Millet in Total Grain Consumption	66.8	91.6	83.8	80.7
9. Compound Millet Production (1976, 1977 mean), kg	1592	4243	3243	3045
10. % of Mean Production Consumed	58%	45%	50%	49%

its diet. In this case, rice imports, unless offset by domestic paddy production, would tend to increase more rapidly than expected.

Another point of importance is the large estimated compound surplus of millet in N'Diamsil and Layabé. Such excesses are available for either sale, gifts, or inter-annual storage. Of interest is the fact that even possessing large excesses of millet, compounds in N'Diamsil as well as in Layabé, regularly purchased rice to diversify their diets.

A final point is the absence of maize consumption by the households. Maize cultivation, however, was successfully introduced during the 1978 agricultural season in N'Diamsil to provide the farmer with another potential source of income. Maize promotion is laudable since it could help limit the growth of rice in the rural diet.

The purchase and sales decisions for grains will be more carefully examined in the succeeding sections.

Section 3 - Purchase of Grains

This section will examine the sample compound's purchase of rice and millet.

A. Rice Purchases

All survey compounds consumed rice to varying degrees. Because none of the compounds are rice cultivators, all rice consumed originates from external sources. The only meaningful source of rice for the household is through purchase, so, as expected, the mean quantity of rice purchased by the compound is nearly identical to mean compound rice consumption. These figures are shown in Table IV.

Second, households purchase rice frequently. The mean annual number of purchases for the typical household was 36.8, representing a purchase every ten days. The mean purchase, 8.3 kilograms, is small, showing that households purchase rice for immediate needs. Table V details rice purchases by weight. For the entire sample, nearly 90 percent of all rice purchases weighed ten kilograms or less.

Rice is usually purchased from small boutiques or stores located in each village. Such an arrangement facilitates credit, negates any transport cost or inconvenience, and permits a near bartering of millet for rice.

TABLE IV

ANNUAL RICE PURCHASES, 1977/78

Group/ Village	Compound Rice Consumption (kg)	Per Capita Rice Consumption (kg)	% of Rice in Grain Diet	Compound Rice Purchases (kg)	Mean Number of Purchases by Compound	Size of Mean Purchase (kg)	Mean Price CFA/kg	Annual Rice[1] Expediture CFA/Compound
Got	448	41	33.2	432	41.5	10.4	85.5	37,048
N'Diamsil	180	14	8.4	168	24.4	6.9	95.1	15,515
Lavabé	309	29	16.0	316	44.5	7.1	89.9	28,240
Sample	312	28	19.3	305	36.8	8.3	90.1	26,934

[1]Household rice expenditure is not exactly equal to household purchases x mean price since the mean price is a simple and not a weighted mean.

TABLE V

RICE PURCHASES BY WEIGHT

Weight (kg)	No. of Purchases	Percentage
0-9	893	79%
10-19	187	17%
20-49	29	2%
50 +	24	2%
Total	1133	100%

Mean purchase 8.3 kilograms

For the entire sample, 1007 or 89 percent of all rice purchases were from small village shops. There were 72 purchases from rural markets (primarily by N'Diamsil residents) and 31 purchases from urban markets (primarily in Thiès by Got residents). The remaining 23 purchases were either from neighbors or from rural traders who possessed a rare or high quality rice.

As suggested by Table IV, official rice prices differ in each of the villages, representing legal transport margins. The slight variations from the mean prices paid and official prices (CFA/kg, 85.5 vs. 85; 95.1 vs. 95; and 89.9 vs 90) can be due to households' purchasing in other markets, a discounting for larger purchases, or a premium for higher quality or scarcer rice. Mean household rice purchases are negatively correlated with the rice price for the three villages. It had been previously stated that Got residents perhaps consumed larger quantities of rice due to their proximity to an urban center, Thiès. The controlled rice price, however, is lowest in Got, also stimulating rice consumption to some extent.

The mean annual compound rice expenditure was 26,934 CFA, or $144.61 (235 CFA/$); this represents approximately 9 percent of the typical compound's 1976 groundnut income.

Often it is claimed that rice purchases result from compounds' exhausting their supply of millet. The hypothesis is that rice purchases increase sharply in June or July, continuing at a high level until the November harvests. For the sample group rice purchases did not show marked seasonality during the year. For N'Diamsil and Layabé it was not possible to reject the hypothesis of an equal monthly mean number of purchases. In Got, the hypothesis of equal means could be rejected; during the months of February-June 1978, mean rice purchases were in excess of those predicted. The primary reason for this was the poor millet harvest in Got of November 1977. The normally millet-deficient Got compound found itself with an even greater millet shortage. Thus, rice purchases were increased beginning a few months after the harvest.

The lack of seasonality of rice purchases in N'Diamsil and Layabé support the hypothesis that rural families purchase rice to diversify their diets. Compounds in these two villages had per capita millet

production in excess of 200 kilograms, yet they voluntarily chose to supplement their diet with rice.

B. Millet Purchases

Since all of these compounds are millet producers, millet sales rather than millet purchases are more common. Eight of the thirty households, however, reported millet purchases in excess of 100 kilograms. These households with their annual consumption and 1977 production are listed in Table VI.

In Got, all households purchasing millet had millet production deficits with respect to their estimated annual millet consumption. These households purchased millet following the poor 1977 harvest.

In N'Diamsil the situation was slightly different, with two of the millet purchasers possessing large production surpluses. An explanation for this is that the 1977 groundnut harvest was particularly unfavorable in N'Diamsil. Some farmers with immediate cash needs were obliged to sell millet, since their anticipated groundnut income was not available. Other farmers in more favorable financial circumstances were willing to purchase millet from these cash-poor farmers, hoping to resell this millet at higher prices later in the year. This perhaps accounts for the purchase of millet by the three surplus compounds in N'Diamsil. No compounds in Layabé reported significant (>10 kilograms) millet purchases.

Section 4 - Sale of Grains

This section will present summary statistics for the sample compounds' selling of millet. Rice sales are unimportant since none of the sample compounds are rice cultivators. After first presenting summary statistics for millet sales, a more detailed interpretation/analysis of these results will be undertaken.

A. General Findings

Table VII indicates that twenty-five of the thirty compounds recorded millet sales during the July 1977 to June 1978 period. Only in Got, where compound millet production was low, were sales limited. The mean for the entire sample was 5.8 sales per year, but with a relatively large coefficient

TABLE VI

MILLET PURCHASES, 1977/78
(PER COMPOUND)

COMPOUND		Millet Purchases (kg)	1977 Millet Production (kg)	Estimated Annual Consumption (kg)	Estimated Surplus (+) Deficit (-) (kg)
Got	1	100	280	778	- 498
	2	250	327	924	- 597
	3	263	440	466	- 26
	4	247	204	484	- 280
N'Diamsil	5	135	7443	4282	3181
	6	170	1164	1206	- 42
	7	500	2935	1555	380
	8	220	3478	1425	2053

TABLE VII

MILLET SALES DATA 1977/1978

	GOT	N'DIAMSIL	LAYABE	SAMPLE
1. Number of compounds selling millet	6	9	10	25
2. Number of compounds selling millet more than 5 times	1	6	8	15
3. Mean number of sales/ compound	1.9	7.4	8.0	5.8
4. Mean weight sold/ compound (Kg)	194	309	306	270
5. Mean number of sales/ compounds selling millet	3.2	8.2	8.0	6.9
6. Mean weight sold/compound selling millet (Kg)	324	343	306	323
7. Weight of mean sale (Kg)	101	42	38	47
8. Total number of sales	19	74	80	173
9. Mean Price (CFA/Kg)[a]	43.2	33.7	36.0	35.8
10. Weighted Mean Price (CFA/Kg.)[b]	43.9	38.9	35.9	38.9
11. Mean revenue/compound selling millet (CFA)	14,224	13,343	10,985	12,565
12. Mean value of 1976 & 1977 groundnut crop (CFA, ($))	160,505 ($683)	154,865 ($659)	275,773 ($1,174)	198,223 ($844)
13. Mean 1977 compound millet production	1222	3655	4015	2964
14. Percentage of crop sold (4 ÷ 13)	16	9	8	11

[a] Mean price per sale of millet

[b] Mean price of millet weighted by the quantity of the sale

of variation.[1]

On average those compounds selling millet sold 323 kilograms, with little variance among villages in this mean quantity. The mean quantity per sale was 47 kilograms.

Compared to 1977 millet production, sales per compound were a small percentage of total production, varying between 8 and 16 percent. This range is consistent with the aggregate estimates of millet marketing in Senegal. A national harvest of 554,000 tons in 1976 provided an estimated 55-65,000 tons of marketed millet, 10-12 percent of production.

While the mean millet price per transaction was 35.8 CFA/kg, the weighted mean price was higher at 38.9 CFA/kg. This indicates that farmers sold disproportionately larger quantities at higher prices. Both means exceed ONCAD's official price of 35 CFA/kg.

Got, because of its proximity to the millet deficient urban areas of Thiès and Cap Vert, reported the highest mean prices. In N'Diamsil the difference between the simple mean and the weighted mean price is noteworthy. This differential results from the fact that larger sales generally occur at the weekly rural market of Touba Toul where traders from Dakar and other urban areas are present. On the other hand, many sales of small quantities of millet (less than twenty kg) are made to small storekeepers within the village. Prices for these sales are lower but the farmer has the convenience of finding an immediate outlet for his millet. He then can purchase rice or other products from the storeowner. In fact, for residents of N'Diamsil, the closest ONCAD marketing secco is at Samba Kané, to which 1.5 CFA/kg of transport expense is generally paid. Thus, even ONCAD's official price of 35 CFA/kg is effectively less interesting for the N'Diamsil farmer than the 33.7 CFA/kg simple mean price. In Layabé, the two mean prices were nearly identical. In summary, the mean millet price was slightly in excess of ONCAD's official price. This casts doubt on the hypothesis that the farmer is obliged to sell large quantities of millet at depressed prices directly following the harvest.

---

[1]This can be more clearly seen by the fact that for the fifteen households reporting more than five sales during the year, the mean was 9.9 sales. For the ten households selling millet less than five times per year, the mean was only 2.4 sales.

As can be seen by comparing revenues from millet to those from groundnut sales, the former are relatively unimportant. The following subsections address (B) the timing of sales, (C) intra-annual price variation, (D) intermediary, (E) pre-harvest contracting of millet, and (F) a modeling of millet sales.

B. Timing of Sales

Table VIII shows the number of millet sales recorded in each month.

TABLE VIII

FREQUENCY OF MILLET SALES 1977/78

		1977						1978					
	Total	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
Got	19	1	2	1	4	6	0	2	0	3	0	0	0
N'Diamsil	74	4	1	3	7	2	13	15	12	5	7	5	0
Layabé	80	3	14	2	5	7	5	8	9	7	13	8	0
Sample	173	8	17	6	15	15	18	25	21	15	20	13	0

Sales are not evenly spaced over the agricultural year. Most sales (114, or 66 percent) are in the six post-harvest months, November-April. Nevertheless, these data do not support the contention that the farmer is obliged to sell millet directly after the harvest. Sales are reported throughout the year and, more importantly, sales are divided over the six month post-harvest period.

In a separate questionnaire the producers had responded that they sell millet:

1) As money needed 23
2) When the price rises 6
3) No response 1

No respondent during the sample period cited the selling or contracting of millet to traders before the harvest.

C. Intra-annual Price Variation

Table IX traces the course of producers prices over the twelve-month period, with the frequency of sales by price for each month shown.

TABLE IX

PRODUCER PRICE FREQUENCY 1977/78

		1977						1978					
CFA/Kg	Total	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
< 29	1	1	0	0	0	0	0	0	0	0	0	0	0
30-34	51	1	1	1	1	1	12	14	12	4	4	0	0
35-39	78	1	2	1	8	8	6	7	9	8	16	13	0
40-44	22	1	10	1	0	0	0	2	1	1	0	0	0
45-59	15	3	1	1	6	6	0	2	0	2	0	0	0
50-54	6	1	3	2	0	0	0	0	0	0	0	0	0
Total	173	8	17	6	15	15	18	25	21	15	20	13	0
Simple Mean	35.8	40.0	40.8	43.	36.7	38.9	31.7	33.5	33.9	35.5	34.5	35.3	-

Using a Chi-square test for equality of the means, it is possible to reject the hypothesis of equal monthly prices. Lower prices (35 CFA or less) tend to be concentrated during the post-harvest months of December-April. Higher prices (35 CFA or more) are more generally found in the May-November period.

More specifically, the lowest monthly mean price is 31.7 CFA/kg in December, directly following the harvest. Prices then begin to rise, reaching a maximum in September. As early millet becomes available in October and the November harvest is anticipated, prices begin to fall.

While the 31.7 CFA/kg millet price is significantly below the mean price for the sample, it should be noted that only 18 sales (10 percent) occurred in December.

Since this December price is below the ONCAD official price, even considering a typical transport charge of 1-1.5 CFA/kg. from a village to an ONCAD secco, it is reasonable to speculate why sales to ONCAD do not occur during this period. The primary reason is that the ONCAD seccos are not opened for millet purchasing until a few weeks after the harvest. The first priority for the seccos is to organize the repayment of producer groundnut debts which can be a one or two month operation. Following this, millet purchasing begins; however, prices on the parellel market start to

exceed those of ONCAD. Assuming the price data presented here is typical, ONCAD could succeed in purchasing millet directly after the harvest as the official price of 35 CFA/kg would then be attractive.[1]

Often it is claimed that seasonal price differentials are sufficiently large for traders to realize excessive profits by storage and resale. Purchasing millet in December and reselling in September or October is the behavior ascribed to these traders. Using the price differentials shown in Table IX, the annual percentage return (r) for a trader purchasing (Dec.) and reselling (Sept.) millet within the rural area would be:

$$1. \quad 43 - \left(SC \cdot \frac{N}{12}\right) = 31.7 \left(1 + r\right)^{\frac{N}{12}}$$

or

$$2. \quad r = \left[\frac{43 - SC \cdot \frac{N}{12}}{31.7}\right]^{\frac{12}{N}} - 1$$

where SC = annual per kilogram storage expense; N = months.
SONED estimates annual storage costs at 5000 CFA/ton while Kohler estimates storage costs at 13,000 CFA/ton.[2] At a storage cost of 9000 CFA/ton, the simple mean of these estimates, a trader's annual return from millet operations would be 19.5 percent. While these calculations are at best indicative, they do not show that excessive profit margins (100-200 percent) are generated by exploiting intra-annual price differentials.

Seasonal millet price behavior appears to be consistent with that predicated by a competitive hypothesis. Prices gradually rise after the harvest, then begin to fall as the next harvesting begins. The annualized rate of return from speculating on seasonal price variations does not support the hypothesis of uncompetitive price behavior.

---

[1]For 1978 ONCAD did succeed in organizing its millet purchasing at harvest time; as a result, estimated millet sales to ONCAD were significantly higher than those reported for the 1977 harvest.

[2]Kohler, Daniel, "Storage of Food Grains in the Sahel", unpublished USAID Report, 1978.

D. Intermediary

Of interest is the intermediary, or party to whom millet is sold. Table X indicates to whom millet was sold in each village.

TABLE X

INTERMEDIARY FOR MILLET SALES

	Got	N'Diamsil	Layabé	Sample
Village Store	1	28	22	51 (30%)
Rural Trader	15	14	55	81 (47%)
Neighbor	3	6	2	11 (6%)
Rural Market	0	25	1	26 (15%)
ONCAD	0	1	3	4 (2%)
TOTAL (percentages)	19	74	80	173 (100%)

The two most common sales outlets were the village store and the travelling rural trader, with 77 percent of all sales involving these parties. ONCAD benefited from only four sales, three of which were by Layabé residents. Certain inter-village differences emerge. In Got, residents dealt primarily with the travelling rural trader or assembler. In contrast, the less accessible N'Diamsil residents either sold to the village assembler or went to the rural market at Touba Toul. Traders are less likely to visit the small, inaccessible villages in the N'Diamsil area, preferring to attend the Saturday market at Touba Toul. Layabé residents relied more on the visiting rural trader.

Statistically, it was possible to reject the hypothesis of no relationship between sales weight and intermediary used for the villages of N'Diamsil and Layabé. Sales of larger quantities of millet (exceeding twenty kg) tended to be concentrated with rural traders (Layabé) or at a rural market (N'Diamsil).

In both villages most smaller sales (less than twenty kg) were transacted at the small village stores.

The above observation for N'Diamsil is consistent with the reported differential between the simple and weighted mean millet prices in that village. Sales of larger quantities of millet, while less frequent than sales of smaller quantities, occurred primarily at the rural market, Touba Toul, where prices were more attractive. The relatively more frequent sales of smaller quantities generally occurred at the village boutiques where prices were slightly less attractive, but where transaction costs are zero.

From the summary of the intermediary used, certain conclusions emerge. First, farmers have many viable alternatives which can be used for millet sales. The hypothesis of a competitive millet market is supported by this observation. While the degree of competition within each market outlet has not been established, the physical existence of many village stores, numerous traders at rural markets, and many travelling traders does suggest that competition is intense, both among and within the sales' outlets. Second, the preferred sales outlet(s) for village residents seems to vary, primarily with the accessibility of the village and its proximity to a major rural market. Finally, only 2 percent of the total sales involved ONCAD, the only legal purchaser of millet.

The sample farmers mentioned various reasons for avoiding ONCAD; as shown in Table XI.

TABLE XI

REASONS FOR AVOIDING ONCAD

Price Too Low	7
Delay or Lack of Payment	9
Inaccurate Weight	4
Other	5
Never Sell Millet	5

Seven of the respondents cited ONCAD's price as being too low. The other complaints concern administrative deficiencies on the ONCAD purchasing program, which could presumably be corrected with increased administrative efficiency. Since the weighted mean price per sale was 38.9 CFA/kg, or 11 percent above ONCAD's official 1977/78 producer price (35 CFA/kg), the ONCAD pricing problem is perhaps more relevant than indicated by the producer responses. The fundamental question of whether ONCAD can offer a price competitive with the private trader is still relevant. The empirical evidence, showing the lack of sales to ONCAD and the high frequency of producer prices in excess of ONCAD's official price suggests that ONCAD's role in millet marketing, except immediately after the harvest, may be difficult to establish.[1]

E. Pre-harvest Contracting of Millet

In this discussion of millet marketing, it was stated that during the time frame of this study, no compounds borrowed money from traders before the harvest with an agreement to repay millet following the harvest. Since this phenomenon at effectively usurious interest rates has often been cited, further investigation was decided upon.

Responding to the question asking from whom they had borrowed money during the year, sixteen of the seventeen compounds with reported borrowings cited a friend/neighbor.[2] In only one of these cases was the repayment in excess of the loan (850 CFA with 1000 repaid). All were short-term loans of less than six months duration. The general rule with respect to cash shortages is that farmers attempt to find more liquid neighbors or friends from whom they can borrow. These friends, either because of social mores or the potential need or reciprocity, do not usually charge any interest.

To explore more fully the often cited phenomenon of farmer's borrowing from traders with the promise to repay millet following the harvest, producers were asked to state such incidents during the last two years.[3]

---

[1]Even if ONCAD establishes a major role as a purchaser of millet, the problem of resale must still be considered.

[2]One family borrowed 10,000 CFA from a trader and reimbursed an identical amount.

[3]The enumerators reported no incidents during the July 1977-June 1978 period.

Table XII reveals twelve cases of such pre-harvest cash borrowing.

TABLE XII

BORROWINGS BEFORE THE HARVEST

	No. of Borrowings	Mean Loan (CFA)	Mean Weight Millet (kg)	Effective Price CFA/kg
Got	1	15,000	500	30
N'Diamsil	4	1,919	64.3	29.8
Layabé	7	3,357	114.3	29.4
Sample	12	3,848	129.8	29.65

Such loans are generally of three to six months in duration, preceeding the harvest. The effective annual rate of interest (r) on these loans can be calculated as follows:

$$1. \quad P^P (129.8) = 3848 (1 + r)^{\frac{N}{12}}$$

or

$$2. \quad r = \left[\frac{P^P(129.8)}{3848}\right]^{\frac{12}{N}} - 1 \quad .$$

where N = duration of loan in months,

P^P = potential price for millet.

At a potential price of 35 CFA/kg for millet, the compounded annual rate of interest is 39.4 percent for a six-month loan and 18.1 percent for a twelve-month loan. At a potential price of 32 CFA/kg, a reasonable post-harvest price in the N'Diamsil or Layabé areas, the effective annual rate is 16.5 percent for a six-month loan. While varying with the potential millet price and the duration of the loan assumed, these derived interest rates do not approach the 100-200 percent returns often cited.

F. Towards a Modeling of Millet Sales

In order to understand more fully the producer's decision to sell millet, a model was specified. Annual producer sales (kg) of millet were assumed

to be a function of the weighted millet price (CFA/kg), the millet per capita annually produced by the compound, and the annual groundnut production of the compound.[1] Both price and millet per capita were assumed to be positive influences on millet sales. Groundnut production was assumed to be negative; lower groundnut production would oblige a compound to sell greater quantities of millet, to compensate for reduced income from groundnut sales. The results of this testing are shown in Table XIII.

TABLE XIII

MILLET REGRESSION MODEL

Independent Variable	Coefficient	Standard Error	Significance
Constant	-1,290.0	549.9	.03
Millet Price (CFA/kg)	29.2	12.3	.03
Millet Production/ Capita[a] (kg)	.85	.38	.04
Groundnut Production[a] (kg)	.05	.017	.001
F Statistic	4.81		.01
R-SQR	.41		
SE	242.2		

Dependent variable: Millet sales per compound (kg)

[a]Mean of 1976 and 1977 production per compound.

The influence of price on millet sales was as expected; higher prices elicited greater sales. An increase of one CFA/kg in the producer millet price would increase sales by approximately twenty-nine kilograms. The implied price elasticity of supply at the mean is 3.51. This suggests that millet sales are relatively price elastic. Such a conclusion should not be

[1]The value of the producer's debt to his cooperative for inputs should also be included as an independent influence; however, these data were not available.

Since the official groundnut price showed no variation over the time frame of this study, nor among villages, groundnut production is a suitable proxy for groundnut income.

surprising; producers, if unsatisfied with the millet price, can always store millet for later consumption, or await a more favorable price.

Millet production per capita was also positive, indicating that millet sales are a function of the millet available to the compound. Increasing per capita millet production by a kilogram indicates that an additional .85 kilograms will be sold.

Finally, the coefficient for groundnut production was positive, negating the hypothesis that lower groundnut production would induce higher millet sales. The most likely explanation for the positive coefficient is the fact that larger millet exploitations are often associated with larger groundnut exploitations. Thus, higher millet production per capita would be associated with higher groundnut production, assuming that yields per hectare are independent of farm size. This problem of multi-colinearity renders an interpretation of the empirical results more difficult.

Adding dummy variables to test for any independent influence by village did not improve the results of the estimated equations, nor were these coefficients significant.

G. Summary

The main findings from this discussion of millet marketing (Parts A-F) are summarized below.

1. The typical compound sold 323 kilograms of millet during the year. At a weighted mean price of 38.7 CFA/kg, this represented 12,565 CFA ($54.) of additional income for the compound.
2. The weighted mean millet price exceeded the simple mean millet price, indicating that disproportionately large quantities of millet were sold at higher prices. Both means, moreover, were in excess of ONCAD's official price of 35 CFA/kg.
3. Millet sales were relatively more frequent during the harvest and post-harvest months of November-April. There was no indication, however, that great quantities of millet were sold immediately after the harvest.
4. Prices showed seasonal variation, with lower prices occurring during the six months following the harvest. Speculating on intra-annual price variations, however, did not generate

inordinate annual returns.

5. Larger quantities of millet were generally sold either to rural traders (Got, Layabé) or at a rural market (N'Diamsil). Smaller quantities were most often sold to village storekeepers who act as rural assemblers.
6. Only four millet sales to ONCAD were reported. ONCAD's low price, delay in payment, and inaccurate weighing were all cited as reasons for avoiding ONCAD.
7. There were no reported incidents of compounds' borrowing money from traders during the survey period in anticipation of the millet harvest. Incidents of such borrowing in the past few years, however, confirmed the possibility of burdensome but not excessive rates of interest associated with this practice.
8. A regression model explaining millet sales confirmed the importance of price in the producer's sales decision. Also, millet production per capita was a positive influence on producer's millet sales.
9. While this study is primarily an investigation of grain disposition rather than an assessment of market performance and efficiency, the results presented here are consistent with the hypothesis of competitive millet marketing.

Section 5 - Gifts, Food Aid, and Borrowing/Lending of Grains

In this section, all other dispositions of grains not previously discussed will be addressed. With the exception of government food aid, a distribution of sorghum, only millet dispositions and transactions will be considered.

A. Gifts

Gifts of millet from the sample compounds were frequent. Table XIV indicates the mean number of gifts and their mean weights by village. For the entire sample, the mean quantity of millet annually given was 52.7 kg per compound. These gifts were typically small quantities of millet destined for rural or urban friends/relatives who were considered financially needy by the giver.

TABLE XIV

ANNUAL GIFTS OF MILLET/COMPOUND

	Mean No. of Gifts	Mean Weight/ Gift (kg)	Mean Weight Given (kg)
Got	2.4	16.8	40.2
N'Daimsil	4.2	8.9	37.4
Layabé	5.8	13.9	80.6
Sample	4.1	12.9	52.7

In Layabé there were three large gifts in excess of 100 kg accorded religious leaders. In the other villages, the lack of large gifts of millet for religious purposes does not imply an absence of religious obligation by this traditional Moslem population. Rather, it could reflect the evolution of monetized transactions in these villages. Since all compounds receive payments for the sale of groundnuts, a monetization of religious obligations should not be surprising.

B. Food Aid

In May and June of 1978, food aid in the form of sorghum was distributed by the government of Senegal to rural residents. This food aid was intended to mitigate the adverse effects of the poor 1977 harvest. Each compound received an amount of sorghum equal to ten kg per inhabitant. According to this distribution rule and the reported populations per compound, the following aid was received:

Got (per compound)	110 kilograms
N'Diamsil (per compound)	139
Layabé (per compound)	116
Sample (per compound)	122

The family's disposition of this aid bears some scrutiny. Since sorghum is viewed as an inferior cereal to millet, and since the typical compound, excluding Got, was self-sufficient in millet production, this

distribution of sorghum did not directly improve the typical family's diet. Much of the sorghum was fed to animals, enriching the animals' diet and allowing the compounds to economize on millet as animal feed. Some compounds reported selling the sorghum either to millet deficient compounds or for use as animal feed. In conclusion, this modest amount of food aid had relatively little impact on the typical compound.

C. Borrowing and Lending

The nature of millet borrowing and loans does not lend itself to clear and simple empiricism. While it was possible to note each incident of an individual compound's loaning millet to another compound with the expectation of being reimbursed and also to note each individual compound's borrowing millet with the intention of reimbursing the millet, matching loans and reimbursements for individual cases proved difficult, for a variety of reasons.

First, many transactions involved compounds outside of the sample but within the same village. To protect the anonymity of the second party, actual names were not recorded. Thus, matching a previous loan with a reimbursement proved impossible. Second, some larger loans are repaid in installments or possibly with money following the harvest, complicating the matching of loans and reimbursements. Finally, some repayments are for loans accorded prior to the sampling period, just as some loans occurred just as the sampling period ended. Thus, one portion of the transaction was outside the sampling period.

Despite the inability to match borrowings and loans, sufficient evidence exists to evaluate the importance of these transactions relative to the compound's millet supply.

Tables XV and XVI show the number of compounds involved in loans and borrowings, the aggregate number of transactions, and the quantity involved.

First, during the twelve month period, twelve of the thirty compounds in the sample loaned millet. The mean loan was only about nine kilograms, sufficient for two days of compound millet consumption (assuming 1477 kg as the annual compound millet consumption; see Chapter IV, Section 2). Borrowing of millet was more frequent, with forty individual transactions involving sixteen compounds. The mean quantity per borrowing was 13.2 kilograms. All borrowings and loans involved a village neighbor as the second party. There

TABLE XV

LOANS OF MILLET (TO NEIGHBORS)

	No. of Compounds w/loans	Total No. of Loans	Total Weight (kg)	Mean Weight Per Loan (kg)
Got	2	2	42	21
N'Diamsil	6	7	48	6.9
Layabé	4	4	26	6.5
Sample	12	13	116	8.92

TABLE XVI

BORROWINGS OF MILLET (FROM NEIGHBORS)

	No. of Compounds w/Borrowings	Total No. of Borrowings	Total Weight (kg)	Mean Weight Per Borrowing (kg)
Got	3	4	92	23.0
N'Diamsil	9	27	378	14.0
Layabé	4	9	57	6.3
Sample	16	40	527	13.2

were no extra-village borrowings/lendings reported. Reported borrowings and lending were generally of small magnitudes; none exceeded 50 kg. Primarily, families borrow millet to compensate for unforeseen shortages of prepared millet. Usually, once a week millet is taken from storage to be threshed and prepared for cooking. Occasionally families underestimate their needs, and will borrow millet, repaying it after the next weekly threshing of millet.

It was not possible to match millet borrowings and repayments to calculate any effective rate of interest associated with these transactions. An independent questionnaire to the sample group, however, revealed that all thirty compounds anticipated repaying or being repaid exactly the quantity involved in the transaction. No interest on these millet loans was expected. Since the loans are generally for convenience, of short duration, and of minimal quantities, such a response should not be surprising. In summary, millet borrowings were not of major importance relative to millet production.

Section 6 - Summary of Major Transactions

The section attempts to integrate the empirical findings from the preceding sections, giving better perspective to the grain dispositions and transactions previously discussed. Ideally, an annual "grains-in, grains-out accounting statement" would simply and conveniently serve as a summary. Unfortunately, calculating grain balances is not a simple task; rather it is complicated by the following factors.

First, there is no time period within which all dispositions can fall. Inter-annual grain storage is common and at the end of any arbitrary accounting time frame, stocks would either be augmented or depleted depending on the grain-in/grain-out differential.

Second, this sample transcended two harvests, 1976 and 1977. This complication is really an extension of the timing problem discussed in point one. Assuming that nearly all of a harvest is disposed of during the year, point one becomes trivial. The complication of point two, however, would still remain.

Third, no reliable estimate of grain losses during harvest, storage or preparation has been generated. The arbitrariness of the per-compound

estimate used in this study understates the importance of this issue. Despite the above problems, Table XVII attempts to summarize the principal uses of grains as found in this village level study.

With the exception of millet used for seed and for animal consumption, each of the noted items has been discussed in preceding sections. Millet seed is relatively insignificant, an estimated 1.5 kg/ha planted. Animal feed in Got and Layabé is relatively important, averaging 213 and 131 kilograms per compound, respectively. In these two communities, animals (horses and cows) are relatively numerous, reflecting their usefulness as draft traction and for transport.

The sum of millet dispositions per compound during the sample period ranged from 1345 kilograms in Got to 2884 in N'Diamsil, with a sample mean of 2236 kilograms. For the entire sample, the 2236 kg represent approximately 75 percent of 1977 millet production, or 73 percent of the mean 1976-1977 production. Got had the largest percentage of production accounted for by the listed items. In fact, with the sharp decline in millet production reported for the 1977 harvest, Got's annualized total of millet disposition would exceed the 1977 harvest.

The typical compound in N'Diamsil and Layabé undoubtedly had additional surpluses of millet. A portion of this millet is kept in on-farm storage, comprising the peasant's security stock against unforeseen events. Due to the widespread knowledge that the 1977 harvest had been worse than 1976 harvest in most parts of Senegal, many farmers with surpluses were holding millet in anticipation of significantly higher millet prices in July-October of 1978. Since these months were outside the sample period, such transactions would not have been noted. Thus, the derived millet "surpluses" for N'Diamsil and Layabé, include some addition to security storage, but could also represent producer speculation with millet.

The only transactions involving rice were consumer purchases. Rice consumption and purchases were nearly identical, since consumers have no rice supply source other than purchasing. Mean compound rice consumption was highest in Got, followed by Layabé. In these two villages, 33 percent and 16 percent, respectively, of annual grain consumption was satisfied by rice. For the entire sample, mean per capita grain consumption was 160 kg, roughly equalling the nutritional standard recommended for rural Senegal.

Chapter V will use these empirical results in assessing the Senegalese government's program for promoting food self-sufficiency.

TABLE XVII

SUMMARY OF GRAIN DISPOSITION (KG/COMPOUND/YEAR)

	Got	N'Diamsil	Layabé	Sample
MILLET				
1. 1976 Production (kg/compound)	1962	4830	2470	3126
2. 1977 Production (kg/compound)	1222	3655	4015	2964
3. Mean 1976-1977 Production (kg/compound)	1592	4243	3243	3045
4. 10 percent post-harvest loss	159	424	324	305
5. Compound Consumption	920	1893	1620	1477
6. Animal Feed	25	213	131	123
7. Sales	194	309	306	270
8. Gifts	40	37	81	53
9. Seed (1.5 kg/ha)	7	8	9	8
10. Total, (4-9)	1345	2884	2471	2236
11. 10. as % of 3	85%	68%	76%	73%
12. 10. as % of 2	110%	79%	62%	75%
RICE				
13. Consumption	448	180	309	312
14. Purchase	432	168	316	305
GRAIN CONSUMPTION				
15. Total/Compound (kg)	1368	2073	1927	1789
16. Per Capita (kg)	128	174	179	160

[a]The larger exploitations in Layabé and N'Diamsil result in a higher animal/compound ratio in these villages; thus the higher per compound millet consumption by animals.

CHAPTER V

MAJOR FINDINGS AND RECOMMENDATIONS

This chapter will review the main findings from this study of producer grain transactions, examining them within the context of official Senegalese agricultural policy. This permits an evaluation of the likelihood of achieving these stated policy objectives.

Essentially, Senegalese objectives for the agricultural sector are to attain food grain self-sufficiency and to increase rural incomes. Specifically, increased local production of grains would replace the 200,000 tons of broken rice annually imported. The reduction in rice imports would greatly aid in alleviating Senegal's perennial current account deficit, assuming no concurrent reduction in groundnut production and export.

The overall self-sufficiency strategy includes actions to affect both the supply and the demand for grains. Significant increases in local rice and maize production are envisioned, with a more modest increase in millet production. From the demand perspective, shifting the composition of grain consumption, particularly in urban areas, towards more millet and maize, with less reliance on rice is a major priority.

While the empirical results of this study do not bear directly on each of those individual actions, some comment will be directed to each point in the strategy.[1]

(1) While increasing domestic paddy production from the current 100,000 tons to 300,000 tons (1985) is technically feasible with water management, the domestic resource cost of this rice will greatly exceed the current cost of imported rice. Assuming this increased paddy production is forthcoming, the government must confront this pricing question, choosing some combination of official producer price decrease, national subsidy, and/or official consumer price increase. A sensitivity of peasant rice purchases to the consumer rice price was indicated by the empirical results of this study (Chapter IV, Section 3). In this case, an increase in the consumer rice price could reduce rural rice consumption but would

---

[1]The assessment of the demand related points is primarily drawn from the author's work on urban consumption in Dakar.
See: Ross, Clark, "Grain Demand and Consumer Preferences", Dakar, Senegal, CRED, June, 1979.

increase rural millet consumption, further limiting the marketing of millet. Also, frustrating the peasants' desire for a more diversified diet, which includes increased rice consumption, could further alienate the rural population from existing government institutions.

(2) Increasing domestic maize production from the current 50,000 tons to 210,000 tons by 1985 appears to be a reasonable possibility. Maize grows quite well in the lower Sine-Saloum, as well as in the Thiès-Diourbel area, the location of the three sample villages. At the official price of 41.5 CFA/kg and with current yields per hectare and per labor unit, peasants would find the profitability of maize nearly equaling that of groundnuts and generally exceeding that of millet. In such a case, the introduction of maize in the Thiès-Diourbel area would probably be at the expense of millet cultivation. Farmers might concentrate on groundnut and maize cultivation, to the detriment of millet. In fact, farmers selling maize at the attractive official producer price would probably increase their consumption of purchased rice, due to the reduction in millet planting.[1] In this case, the objectives of food self-sufficiency and reduced rice imports would not be achieved.

Also, producer experiences with ONCAD as a purchaser of primary grains (Chapter IV, Section 4) cast doubt on ONCAD's ability to coordinate the projected increase in marketed maize.

(3) Increasing domestic millet production from 550,000 to 730,000 tons (1985) is relatively unlikely at current producer prices. The empirical results of this study have shown that producers concentrate resources into the production of groundnuts, a more profitable production possibility. To induce farmers to increase millet production at the expense of groundnuts would necessitate some change in the relative prices of the two crops. Reducing the producer groundnut price would be a politically unacceptable alternative, given Senegal's commitment to increasing rural incomes. Increasing the official producer price of millet from 35 CFA/kg to the estimated 55 CFA/kg needed to equalize the profitability of the two crops would imply a cost price for millet of 85-90 CFA/kg in Dakar after adding all intermediate expenses. At that price, it is highly unlikely that urban demand could absorb an increased millet supply.

---

[1]The cost per kilogram of purchased rice expressed in terms of a locally grown cereal has been reduced due to the greater profitability of maize than that of millet.

(4) Reducing rice consumption from a projected 335,000 tons to 234,000 tons in 1985 would primarily be achieved by limiting urban rice demand, with increased millet and maize consumption. Reducing urban rice demand, without sharply increasing rice prices, will be difficult. Of equal concern, the growing attachment to rice by the rural sector could result in further increases in national rice consumption. The typical rural family sampled in this study had 19 percent of its grain needs satisfied by rice. Assuming that rice is a normal good and diet diversification a continued objective, rising rural incomes will lead to increases in rice demand. Thus, achieving a reduction in national rice consumption depends not only on the behavior of the urban population but also on that of the rural sector.

(5) Stimulating maize flour consumption in both urban and rural areas is an important objective, considering the projected maize production increases. A large portion of this planned maize consumption would be in rural areas. Attracting the rural population to greater maize consumption would be particularly benefitial if accompanied by a concurrent reduction in rural rice demand. Maize, which can be prepared in a fashion similar to broken rice, could then serve to promote a more diversified grain diet. As previously explained, the rural population is currently consuming rice to diversify its traditionally millet-based diet.

(6) Increasing millet flour consumption is primarily aimed at the urban population, whose current rice-based diet is the source of the costly dependence on rice imports. Since the typical rural household in this sample had a grain diet dominated by millet (81 percent), it is unlikely that further increases in the proportion of millet in the rural sector's diet can be achieved.

Generally, the empirical results of this study of producer grain transactions are not supportive of Senegal's objectives for the agricultural sector. On the supply side, introducing maize could lead to reductions in millet cultivation. Secondly, without some price incentive, it is unlikely that millet production can be significantly increased. On the demand side, reducing rice consumption is hindered by the rural population's desire for a more diversified diet. Increasing rural millet consumption is complicated by the same desire for a varied diet.

The main theme emerging from this study of rural producers is the necessity to consider their behavioral patterns in formulating national policy. Too often, a sterotyped model of peasant behavior has been assumed. Successfully designing agricultural policy for Senegal requires not only an understanding of urban grain demands but a thorough comprehension of producer decision making with respect to resource allocation, sales, and consumption patterns. It is hoped that this study has shown the interrelationship between such behavior and the design of national policy.

REFERENCES

Center for Research on Economic Development, Marketing Price Policy and Storage of Food Grains in the Sahel, Volume II. Country Studies, University of Michigan, 1977.

Fall, Moussa, "Interpretation Statistique des Données Economiques de la Campagne 1976-77 dans les Terroirs de: Got-N'Diamsil-Layabé." Institut Sénégalais de Recherches Agronomiques, Bambey, Sénégal, 1977.

Hays, H.M. Jr., "The Marketing and Storage of Food Grains in Northern Nigeria." Samaru Miscellaneous Paper 50, Institute for Agricultural Research, Zaria, Nigeria, 1975.

Jones, William O., Marketing Staple Food Crops in Tropical Africa. Cornell University Press, Ithaca, New York, 1972.

Kleene, Paul, "Notion d'Exploitation Agricole et Modernisation en Milieu Wolof-Saloum." L'Agricole Tropical XXI-1, Paris, Janvier-Mars, 1976.

Kohler, Daniel, "Storage of Food Grains in the Sahel." Unpublished USAID Report, 1978.

Lele, Uma J., Food Grain Marketing in India: Private Performance and Public Policy. Ithaca, Cornell University, New York, 1971.

SONED, Etude Sur la Commercialisation et le Stockage des Céréales au Sénégal, Tome 1,2. Dakar Sénégal, 1977.